

What is claimed is:

1                   1. A composition for treating a metal surface to improve paint adhesion and  
2 corrosion resistance, said composition comprising water, an organo-functional silane, a  
3 compound of a group IV-B element, and a polymer blend having a plurality of carboxylic  
4 functional groups and a plurality of hydroxyl groups.

1                   2. The composition of claim 1, wherein the ratio of equivalents of carboxylic  
2 functional groups to hydroxyl groups is between 0.3:1.0 and 3.5:1.0.

1                   3. The composition of claim 1, wherein the weight ratio of silane to polymer  
2 blend is between 0.25:1 and 2.0:1.

1                   4. The composition of claim 1, wherein the weight ratio of silane to polymer  
2 blend is between 0.5:1 and 1.0:1.

1                   5. The composition of claim 1, wherein said organo-functional silane is selected  
2 from the group consisting of an aminopropyltriethoxy silane, a mercapto silane, and an epoxy  
3 silane.

1                   6. The composition of claim 1, wherein said polymer blend comprises a first  
2 polymer having carboxylic functional groups and a second polymer having hydroxyl groups.

1                   7. The composition of claim 6, wherein said first polymer is selected from the  
2 group consisting of polyacrylic acid and polymethylvinylether-co-maleic acid and said second  
3 polymer is polyvinyl alcohol.

1                   8. The composition of claim 1, wherein said compound of a group IV-B  
2 element is an acid selected from the group consisting of fluozirconic acid, fluotitanic acid, and  
3 fluohafnic acid.

1                   9. A composition for treating a metal surface to improve paint adhesion and  
2 corrosion resistance, said composition consisting essentially of water, an organo-functional  
3 silane, a compound of a group IV-B element, and a polymer blend having a plurality of  
4 carboxylic functional groups and a plurality of hydroxyl groups.

1                   10. The composition of claim 9, wherein the ratio of equivalents of carboxylic  
2 functional groups to hydroxyl groups is between 0.3:1.0 and 3.5:1.0.

1                   11. The composition of claim 9, wherein the weight ratio of silane to polymer  
2 blend is between 0.25:1 and 2.0:1.

1                   12. The composition of claim 9, wherein the weight ratio of silane to polymer  
2 blend is between 0.5:1 and 1.0:1.

1                   13. The composition of claim 9, wherein said organo-functional silane is  
2 selected from the group consisting of an aminopropyltriethoxy silane, a mercapto silane, and an  
3 epoxy silane.

1                   14. The composition of claim 9, wherein said polymer blend comprises a first  
2 polymer having carboxylic functional groups and a second polymer having hydroxyl groups.

1                   15. The composition of claim 14, wherein said first polymer is selected from the  
2 group consisting of polyacrylic acid and polymethylvinylether-co-maleic acid and said second  
3 polymer is polyvinyl alcohol.

1                   16. The composition of claim 9, wherein said compound of a group IV-B  
2 element is an acid selected from the group consisting of fluozirconic acid, fluotitanic acid, and  
3 fluohafnic acid.

1                   17. A method for treating a metal surface to improve paint adhesion and  
2 corrosion resistance comprising contacting the metal surface with a composition comprising  
3 water, an organo-functional silane, a compound of a group IV-B element, and a polymer blend  
4 having a plurality of carboxylic functional groups and a plurality of hydroxyl groups.

1                   18. The method of claim 17, wherein the ratio of equivalents of carboxylic  
2 functional groups to hydroxyl groups is between 0.3:1.0 and 3.5:1.0.

1                   19. The method of claim 17, wherein the weight ratio of silane to polymer blend  
2 is between 0.25:1 and 2.0:1.

1                   20. The method of claim 17, wherein the weight ratio of silane to polymer blend  
2 is between 0.5:1 and 1.0:1.

1                   21. The method of claim 19, wherein the organo-functional silane is selected  
2 from the group consisting of an aminopropyltriethoxy silane, a mercapto silane, and an epoxy  
3 silane.

1                   22. The method of claim 17, wherein said polymer blend comprises a first  
2 polymer having carboxylic functional groups and a second polymer having hydroxyl groups.

1                   23. The method of claim 22, wherein said first polymer is selected from the  
2 group consisting of polyacrylic acid and polymethylvinylether-co-maleic acid and said second  
3 polymer is polyvinyl alcohol.

1                   24. The method of claim 9, wherein said compound of a group IV-B element is  
2 an acid selected from the group consisting of fluozirconic acid, fluotitanic acid, and fluohafnic  
3 acid.

1                   25. The method of claim 17, wherein the metal surface is an aluminum surface.

1                   26. A method for treating a metal surface to improve paint adhesion and  
2 corrosion resistance comprising the steps of:

3                   cleaning the metal surface to form a cleaned metal;

4                   rinsing the cleaned metal with water to form a rinsed metal; and

5                   contacting the rinsed metal with a composition comprising water, an organo-functional  
6 silane, a compound of a group IV-B element, and a polymer blend having a plurality of  
7 carboxylic functional groups and a plurality of hydroxyl groups.

1                   27. The method of claim 26 further comprising, after the contacting step, the  
2 steps of:

3                   drying the metal surface; and

4                   then painting the metal surface with an acrylic paint.

1                   28. The method of claim 27, wherein the acrylic paint comprises titanium  
2 dioxide, normal butyl alcohol, xylene, heavy aromatic solvent naphtha, diacetone alcohol, a

3 ketone mixture, light aromatic solvent naphtha, one or more film formers, and one or more  
4 resins.

1 29. The method of claim 26, wherein the cleaning step comprises contacting the  
2 metal surface with an alkaline cleaner.

1 30. The method of claim 29, wherein the alkaline cleaner comprises potassium  
2 hydroxide, gluconic acid, and either tetrasodium ethylenediaminetetraacetate or a combination  
3 of potassium silicate and sodium tri polyphosphate.